(57) Abstract: Masonry (1) comprising layers (2) of bricks and mortar joints (3), whereby at least one mortar joint (3) is reinforced by a reinforcement strip (4), whereby said strip (4) comprises at least two straight, continuous, substantially parallel, steel reinforcement wires (5), which are welded or glued to each other by means of a steel wire connecting structure (6), characterised in that the wire connecting structure (6) is provided with protruberances (7) protruding from the plane comprising said at least two straight reinforcement wires (5) and forming spacing elements (7) which keep the at least two straight reinforcement wires (5) at a specific distance from the layer (2) of bricks below and/or the layer (2) of bricks above said reinforcement strip (4).
MASONRY WITH STEEL REINFORCEMENT STRIP HAVING SPACERS

Description

Technical Field

[0001] This invention relates to a masonry comprising layers of bricks or building stones and mortar joints, whereby at least one mortar joint is reinforced by a reinforcement strip, whereby said strip comprises at least two straight, continuous, substantially parallel, steel reinforcement wires, which are connected to each other by means of a steel wire connecting structure.

Background Art

[0002] Such a masonry is already known from the USA patents 2300181, 2929238 and 3183628.

[0003] The correct application of adjacent layers of bricks, mortar joints and reinforcement strips in the mortar joints results in a masonry which can take up high tensile forces and shear forces compared with a masonry without reinforcement strips.

[0004] An important condition for obtaining a correct construction of such a masonry is the necessity of obtaining a good adherence between the reinforcement wires of the reinforcement strip and the mortar joints, as is clearly described in the USA patent 3183628. This good adherence, disclosed in the USA patent 3183628, is obtained by providing the two longitudinal side rods or steel reinforcement wires with a plurality of spaced bosses on the opposite sides of each of the side rods, whereby the bosses on one side of each rod are in staggered relationship to the bosses on the other side thereof. The disadvantage hereby is that an additional, expensive transformation or deformation of the side rods or reinforcement wires is necessary.

[0005] Another solution for obtaining a good adherence between the steel reinforcement wires of the reinforcement strip and the mortar joints is to take care that the reinforcement wires are completely embedded or
surrounded by the mortar of the joint.

[0006] Therefore, the existing instructions for applying a known reinforcement strip, as disclosed in the USA patents 2300181 and 2929238, are as follows: apply firstly a mortar layer on the upper surface of the last layer of bricks, then apply the reinforcement strip or distribute mortar from the first applied layer and, finally, apply another mortar layer on the strip before the next layer of bricks is applied.

[0007] This is a rather cumbersome operation and it has been stated that masons at the building site are normally following another way of operation: applying firstly the reinforcement strip on the upper side of the last laid layer of bricks followed by applying a mortar layer before the next layer of bricks is applied. A disadvantage thereof is that the reinforcement wires are not completely embedded or have not sufficient adherence with the mortar of the joint to take up high tensile forces.

 Disclosure of Invention

[0008] It is an object of the invention to provide a new type of masonry, whereby the reinforcement wires of the reinforcement strip are always sufficiently embedded in the mortar joint.

[0009] This object has been solved in the USA patent 6629393 B2 by providing the two longitudinal rods or reinforcement wires of the wire strip with a plurality of bent portions integrally formed and evenly spaced along the length thereof. These bent portions of each metal rod extend downwardly and/or upwardly from the plane formed by the two longitudinal rods or reinforcement wires.

[0010] A disadvantage of this solution according to the USA patent 6629393 B2 is, that the bent longitudinal rods or wires are not able to take up high tensile forces because the rods are weakened by these bent deformations and can only take up the applied tensile forces after the bent portions are sufficiently straightened. This straightening of the bent portions in the
mortar joint will normally lead to fractures of the mortar joint.

[001 1] It is therefore a further object of the invention to provide a new type of masonry, whereby the reinforcement wires of the wire strip are sufficiently embedded in the mortar joint, but without lowering the tensile strength of the longitudinal wires.

[001 2] This object is solved in a known masonry by providing the wire connecting structure with protuberances protruding from the plane comprising said at least two straight reinforcement wires and forming in this way spacing elements which keep the at least two straight reinforcement wires at a specific distance from the layer of bricks below in order to guarantee the embedment of the reinforcing steel, when the mortar is applied after the laying of the reinforcing strips on the layer of brick below.

[001 3] Preferably a mortar layer may also be provided above the reinforcing strip, i.e. between the reinforcing strip and the above layer of bricks.

[001 4] It is clear, that in this way, the straight reinforcement wires are not weakened by any deformation operation and maintain their full tensile strength along their whole length.

[001 5] Moreover, the reinforcement wires are completely embedded in the mortar joint.

[001 6] Within the context of the present invention, the term "wire" is not limited to hard drawn wires with a circular cross-section. The term "wire" also covers non-drawn wires such as wires made of sheet material and profile wires with a non-round cross-section, e.g. a rectangular or square cross-section. The reinforcement wires must be able to take up tensile forces present in a mortar joint. In case the wire is made of sheet material, the cross-section is made greater than the cross-section of a comparable hard drawn wire in order to enable the required take up of tensile forces.

[001 7] Another masonry according to the invention is characterised in that the wire connecting structure is bent to provide the protuberances protruding
from the plane comprising said at least two straight reinforcement wires for forming the spacing elements.

[0018] A further embodiment of the masonry according to the invention is characterised in that the protuberances of the wire connecting structure are present at both sides of the plane comprising said at least two straight reinforcement wires.

[0019] Still a further embodiment of the masonry according to the invention is characterised in that the bent protuberances of the wire connecting structure are forming a crenel-form or sinusoidal-form.

[0020] In a preferable embodiment of the masonry according to the invention, the protuberances or spacing elements of the wire connecting structure are located as close as possible to the steel reinforcement wires, i.e. within a distance of maximum 10 cm from the connecting points between the wire connecting structure and the steel reinforcing wires, e.g. within a distance of maximum 8 cm, e.g. of maximum 5 cm, e.g. of maximum 3 cm. The reason is that the wire strips are also used to reinforce walls where the bricks have hollow spaces inside. In case the spacing elements are located in the middle of the wire connecting structure, the protuberances risk to fall inside the hollow spaces and to miss completely their spacing function.

[0021] The invention also relates to a reinforcement strip for manufacturing a masonry according to the invention comprising at least two straight, continuous, substantially parallel, steel reinforcement wires, which are welded to each other by means of a steel wire connecting structure, whereby the wire connecting structure is provided with protuberances protruding from the plane comprising said at least two straight reinforcement wires and forming in this way spacing elements for the reinforcement strip.
Another reinforcement strip according to the invention is characterised in, that the wire connecting structure is bent to provide the protuberances protruding from the plane comprising said at least two straight reinforcement wires for forming the spacing elements.

A further embodiment of a reinforcement strip according to the invention is characterised in, that the protuberances of the wire connecting structure are present at both sides of the plane comprising said at least two straight reinforcement wires.

Still a further embodiment of a reinforcement strip according to the invention is characterised in, that the bent protuberances of the wire connecting structure are forming a crenel-form or sinusoidal-form.

In a preferable embodiment of the steel strip according to the invention, the protuberances or spacing elements of the wire connecting structure are located as close as possible to the steel reinforcement wires, i.e. within a distance of maximum 10 cm from the connecting points between the wire connecting structure and the steel reinforcing wires, e.g. within a distance of maximum 8 cm, e.g. of maximum 5 cm, e.g. of maximum 3 cm. The reason is that the wire strips are also used to reinforce walls where the bricks have hollow spaces inside. In case the spacing elements are located in the middle of the wire connecting structure, the protuberances risk to fall inside the hollow spaces and to miss completely their spacing function.

It is to be noted, that steel wire strips comprising two straight wires and a wire connecting structure, whereby the steel wire connecting structure is provided with protuberances protruding from the plane comprising said two straight wires, are already known from the USA patents 4190999 and 4305239.

The USA patent 4190999 teaches downwardly projecting legs for fixing the steel wire strip in a correct position on the upper surface of the layer of
bricks. These legs are not used as spacing elements, as taught in the present invention.

[0028] The USA patent 4305239 also discloses downwardly valleys in a cavity wall, whereby these valleys are used for guiding droplets in the cavity of the wall. Here again, these valleys are not used as spacing elements, as taught in the present invention.

**Brief Description of Figures in the Drawings**

[0029] The invention will now be further explained by means of some examples of masonries according to the invention and with reference to a number of figures.

[0030] Figure 1 shows a perspective view of a part of a masonry comprising two layers of bricks and an intermediate mortar joint, reinforced with a reinforcement strip.

[0031] Figure 2 shows a cross-section of the embodiment of figure 1 along the line ll-r in figure 1.

[0032] Figure 3 shows a cross-section similar to figure 2, but with another form of the reinforcement strip.

[0033] Figure 4 shows a cross-section similar to figures 2 and 3, but with still another form of the reinforcement strip.

[0034] Figure 5a and Figure 5b illustrate a particular embodiment of a ladder type of reinforcement strip.

[0035] Figure 6a, Figure 6b and Figure 6c illustrate reinforcing strips according to the invention where the spacing elements are close to the reinforcing wires.
Mode(s) for Carrying Out the Invention

[0036] Figure 1 shows a perspective view of a small part of a masonry 1 comprising two adjacent layers 2 of bricks and an intermediate joint 3 of mortar or another adhesive. The joint 3 is reinforced by means of a reinforcement strip 4.

[0037] The reinforcement strip, as shown in figure 1, comprises two straight, continuous, substantially parallel, steel reinforcement wires 5, which are welded to each other by means of a steel wire connecting structure 6. This shown steel wire connecting structure 6 runs between the two reinforcement wires 5 along a substantially zig-zag line. Such a steel wire reinforcement strip is e.g. described in the USA patents 2300181 and 3183628. Such a steel wire reinforcement strip is called a truss type. It is possible to replace this steel wire connecting structure 6 with a zig-zag form by a steel wire connecting structure in the form of a series of cross members, as described in the USA patents 2929238 and 6629393 B2. Such a steel wire reinforcement strip is called a ladder type.

[0038] The length of the continuous wires 5 is e.g. ranging between 2500 mm. and 3500 mm.; whereas the diameter of these wires is ranging between 4 and 6 mm. and the distance between the wires 5 is ranging between 30 mm to 280 mm, e.g. from 50 mm to 200 mm. The diameter of the zig-zag steel wire connecting structure 6 is ranging between 2 to 4 mm. The thickness of the mortar joint 3 is ranging between 8 to 15 mm. All the above given numbers are only mentioned for information purposes and do not limit the scope of the invention. It is clear, that all these mentioned dimensions are defined in first instance by the dimensions of the used bricks and the dimensions of the masonry wall to be built.

[0039] The wire connecting structure 6 is provided with protuberances 7 protruding from the plane comprising the two reinforcement wires 5. As can be seen in figure 1, the protuberances 7 are formed by bending some parts of the wire connecting structure 6 out of the plane formed by the two reinforcement wires 5 and at the same side of this plane. It would be
possible to provide each length of wire 6 between the longitudinal wires 5 with at least one protuberance.

[0040] However, in the embodiment of figure 1, there is only formed one protuberance for each pair of successive steel wire lengths.

[0041] The protuberances 7 having a certain depth (or height) of e.g. 1 to 6 mm, e.g. from 1 mm to 4 mm, e.g. a maximum depth of 3 mm or 2 mm, with respect to the plane formed by the upper part of the two reinforcement wires 5 and are forming in this way spacing elements or distance holders for the reinforcement strip 4. These spacing elements 7 define in this way a specific distance between the two layers 2 of the bricks or define in this way a certain thickness of the joint 3 between the two brick layers 2.

[0042] The protuberances 7 can have an additional deformation (not shown) in a plane parallel to the plane of the reinforcement wires 5. This additional deformation, although requiring yet another step of processing, has the advantage of providing a stable basis for the reinforcement strip on the previous layer of bricks.

[0043] Figure 2 shows clearly that each protuberance or spacing element 7 of a length of wire 6 of the first embodiment of the reinforcement strip 4 is designed to support on the upper surface of the lower layer 2 of bricks. It is clear, that by means of the spacing elements 7, the reinforcement wires 5 are situated at a desired or specific distance above the upper surface of the lower layer of bricks and therefore are correctly embedded in the mortar joint 3.

[0044] As can be seen from the cross-section of the embodiment of the strip 4, shown in figure 3, the protuberances or spacing elements 7 are now designed to extend upwardly (dashed lines) and downwardly (full lines) from the plane defined by the two longitudinal reinforcement wires 5. It is again clear, that the reinforcement wires 5 are situated at a certain distance above the upper surface of the lower layer 2 of bricks, but also at a certain distance under the lower surface of the upper layer 2 of bricks
because the protuberances or spacing elements 7 are now designed to contact the upper surface of the lower layer 2, as well as the lower surface of the upper layer 2. This means that the reinforcement wires 5 are still better embedded in the mortar joint 3.

[0045] A reinforcement strip 4 with both protuberances 7 upward and downward is very advantageous. First of all it can be placed on any side, there will always be a gap created both under and above the reinforcement wires 5. The function of the reinforcement strip is not to keep a fixed and constant distance between two layer of bricks, as disclosed in US-A-2004/1 82029, but to allow the reinforcement wires to be completely embedded in mortar. A layer of mortar is preferably provided above the reinforcement strip.

[0046] Figure 4 shows a cross-section through a masonry 1 with still a further embodiment of the reinforcement strip 4. The reinforcement strip 4 is a ladder-type strip, whereby some steel wires 6 connecting the two reinforcement wires 5 are bent to form protuberances or spacing elements 7 showing a substantially crenel-form. All the undulations or corrugations of the deformed steel connecting wires 6 have the same height or depth. It is also possible to deform the steel wire connecting wires 6 to give these wires 6 a substantially sinusoidal form.

[0047] Figure 5a shows a cross-section of another embodiment of a reinforcement strip 4 at a certain location and Figure 5b shows a cross-section of this another embodiment of a reinforcement strip 4 at another location. This reinforcement strip 4 is of the ladder type, i.e. the connecting structure 6 comprises several separate pieces of wire. The separate pieces of wire are point welded alternatingly above the plane of the reinforcement wires 5 (Figure 5a) and under the plane of the reinforcement wires (Figure 5b). In case of an upward protuberance 7, the wire piece is point welded above the reinforcement wires 5 (Figure 5a). In case of a downward protuberance 7, the wire piece is point-welded under the reinforcement wires 5 (Figure 5b). The embodiment of Figure 5a and Figure 5b has the advantage that the height or depth of the protuberances can be reduced with the thickness or diameter of the reinforcement wires.
Instead of point-welding the wire pieces above and under the reinforcement wires, a ladder type or reinforcement strip may also be made by butt-welding the wire pieces within the plane of the reinforcement wires.

Figure 6a, Figure 6b, and Figure 6c all illustrate embodiments of the reinforcement strip 4 where the spacing elements $T, 7''$ are located closely to the reinforcement wires 5 in order to avoid that the spacing elements fall inside the hollow space of certain bricks.

The embodiment of Figure 6a is of a zigzag type reinforcement strip 4. Each piece 6 of connecting wire has two parts $T$ which have been bent downwards and two parts $7''$ which have been bent upwards. The reason for providing both downwards and upwards bending is that the strip will provide its spacing function independent of the way it is laid down on the layer of bricks. The spacing elements $T, 7''$ may each have a length of 1.5 cm to 2.5 cm in order to provide sufficient stability to the reinforcing strip on the layer of bricks and yet to avoid too much contact between the connecting wires and the layer of bricks.

The embodiment of Figure 6b is also of a zigzag type reinforcement strip 4 but here each piece 6 of connecting wire has only one part $7'$ and one part $7''$. Experience has shown that this is sufficient for stability.

The embodiment of Figure 6c is of a ladder type. Each piece 6 of connecting wire has two parts $7'$ which have been bent downwards and two parts $7''$ which have been bent upwards.
Claims

Claim 1. Masonry (1) comprising layers (2) of bricks and mortar joints (3), whereby at least one mortar joint (3) is reinforced by a reinforcement strip (4), whereby said strip (4) comprises at least two straight, continuous, substantially parallel, steel reinforcement wires (5), which are connected to each other by means of a steel wire connecting structure (6) which is glued or welded to the steel reinforcement wires (5), characterised in that the wire connecting structure (6) is provided with protuberances (7) protruding from the plane comprising said at least two straight reinforcement wires (5) and forming spacing elements (7) which allow an embedment of the steel reinforcement wires (5) in the mortar.

Claim 2. Masonry (1) according to claim 1, characterised in that the wire connecting structure (6) is bent to provide the protuberances (7) protruding from the plane comprising said at least two straight reinforcement wires (5) for forming the spacing elements (7).

Claim 3. Masonry (1) according to claim 1 or claim 2, characterised in that the protuberances (7) of the wire connecting structure (6) are present at both sides of the plane comprising said at least two straight reinforcement wires (5).

Claim 4. Masonry (1) according to claim 3, characterised in that the bent protuberances (7) of the wire connecting structure (6) are forming a crenel-form or sinusoidal-form.

Claim 5. Masonry (1) according to any one of the preceding claims, wherein said spacing elements (7) are located within a distance of maximum 10 cm, e.g. maximum 5 cm, e.g. maximum 3 cm from the connecting points between the wire connecting structure (6) and the steel reinforcing wires (5).
Claim 6. Masonry (1) according to any one of the preceding claims, wherein a layer of mortar is present between said reinforcing strip and the above layer of bricks.

Claim 7. Masonry (1) according to any one of the preceding claims, wherein said protuberances have a depth of maximum 6 mm, e.g. maximum 4 mm, e.g. maximum 2 mm from the plane formed by the upper part of the straight reinforcing wires.

Claim 8. Reinforcement strip (4) for manufacturing a masonry according to claim 1 comprising at least two straight, continuous, substantially parallel, steel reinforcement wires (5), which are welded to each other by means of a steel wire connecting structure (6), characterised in that the wire connecting structure (6) is provided with protuberances (7) protruding from the plane comprising said at least two straight reinforcement wires (5) and forming spacing elements (7).

Claim 9. Reinforcement strip (4) according to claim 8, characterised in that the wire connecting structure (6) is bent to provide the protuberances (7) protruding from the plane comprising said at least two straight reinforcement wires (5) for forming the spacing elements (7).

Claim 10. Reinforcement strip according to claim 8 or claim 9, characterised in that the protuberances (7) of the wire connecting structure (6) are present at both sides of the plane comprising said at least two straight reinforcement wires (5).

Claim 11. Reinforcement strip according to claim 10, characterised in that the bent protuberances (7) of the wire connecting structure (6) are forming a crenel-form or sinusoidal-form.
Claim 12. Reinforcing strip according to any one of claims 8 to 11, wherein said spacing elements (7) are located within a distance of maximum 10 cm, e.g. maximum 5 cm, e.g. maximum 3 cm from the connecting points between the wire connecting structure (6) and the steel reinforcing wires (5).

Claim 13. Reinforcing strip according to any one of claims 8 to 12, wherein said protuberances have a depth of maximum 6 mm, e.g. maximum 4 mm, e.g. maximum 2 mm from the plane formed by the upper part of the straight reinforcing wires.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

E04B2/02 E04G21/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

E04G E04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>NL 1 000 665 C (THIBODRAAD) 31 December 1996 (1996-12-31) figures 1,2</td>
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Further documents are listed in the continuation of Box C

X See patent family annex

* Special categories of cited documents

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

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Date of the actual completion of the international search

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